INTERNATIONAL IMAGE SENSOR SOCIETY

2015 INTERNATIONAL IMAGE SENSOR WORKSHOP

Vaals, Netherlands. June, 8-11, 2015

PROGRAM

Monday, June 8th 2015

08:00 - 08:45 Registration

08:45 - 09:00 **Welcome and Opening**

09:00 - 09:20 **Introductory paper**:

1.01 **The State-of-the-Art of Mainstream CMOS Image Sensors**
Ray Fontaine
Competitive Technical Intelligence Group, Chipworks, Inc., Canada

Session 01 Image Sensors for Digital Photography

09:20 - 09:35 1.02 **Back-side illuminated 28M-pixel APS-C sensor with high performance**
Sungsoo Choi, Seung Hyun Lim, Moosup Lim, Hyung Jin Bae, Kyo Jin Choo, Jung Hoon Park, Kang Sun Lee, Seung Sik Kim, Jungho Moon, Kyungmok Son, Eun Sub Shim, Hankook Cho, Yitae Kim, Seog Heon Ham, JungChak Ahn, Chang Rok Moon and Duckhyung Lee
Samsung Electronics, System LSI Division , Gyeonggi-city, Gyeonggi-do, Korea

09:35 - 09:50 1.03 **A Low Noise and High Sensitivity Image Sensor with Imaging and Phase-Difference Detection AF in All Pixels**
M.Kobayashi, M.Johnson, Y.Wada, H.Tsuboi, J.Iwata, T.Ono, H.Takada, K.Togo, Y.Arishima, T.Kishi, A.Okita, H.Takahashi, T.Ichikawa
Canon Inc., Japan

09:50 - 10:05 1.04 **A 4M pixel full-PDAF CMOS image sensor with 1.58μm 2X1 On-Chip Micro-Split-Lens technology**
Sozo Yokogawa[1], Isao Hirota[1], Isao Ohdaira[1], Masao Matsumura[1], Atsushi Morimitsu[1], Hiroaki Takahashi[1] Toshio Yamazaki[2], Hideki Oyaizu[2],Yalcin Incesu[3], Muhammad Atif[3], Yoshikazu Nitta[1]
[1] Sony Corporation, Atsugi, Kanagawa, Japan
[2] Sony Corporation, Osaki, Shinagawa-ku, Tokyo, Japan
[3] Sony Deutschland GmbH, Stuttgart, Germany

10:05 - 10:20 1.05 **Recent developments on large-area CCDs for professional applications**
Jan Bosiers, Erik-Jan Manoury, Wilco Klaassens, Holger Stoldt, René Leenen, Harry van Kuijk, Herman Peek, Walter de Laat
Teledyne DALSA Professional Imaging
High-Tech Campus 27, 5656AE Eindhoven, The Netherlands

10:20 – 10:40 **Break**

Session 02 Stacked Image Sensors

10:40 - 10:55 2.01 **Stack Chip Technology: A New Direction for CMOS Imagers**
V.C. Venezia, H. Rhodes, C. Shih, W.Z. Yang, and B. Zhang
OmniVision Technologies, Santa Clara, USA

10:55 - 11:10 2.02 **A 3D stacked CMOS image sensor with 16Mpixel global-shutter mode using 4 million interconnections**
Toru Kondo, Yoshiaki Takemoto, Kenji Kobayashi, Mitsuhiro Tsukimura, Naohiro Takazawa, Hideki Kato, Shunsuke Suzuki, Jun Aoki, Haruhisa Saito, Yuichi Gomi, Seisuke Matsuda and Yoshitaka Tadaki,
Olympus Corporation Japan

11:10 - 11:25 2.03 **A 1/1.7-inch 20Mpixel Back-illuminated Stacked CMOS Image Sensor with parallel multiple sampling**
Hayato Wakabayashi[1], Atsushi Suzuki[1],Nobutaka Shimamura[1],Toshiki Kainuma[1], Kensuke Koiso[3], Atsushi Masagaki[1], Yoichi Yagasaki[1], Shigeru Gonoi[2], Masatoshi Mizuno[2], Tatsuya Sugioka[1],Takafumi Morikawa[1], Yoshiaki Inada[1]
[1]Sony, Atsugi, Japan, [2]Sony LSI Design, Atsugi, Japan, [3]Sony Semiconductor, Kumamoto, Japan

11:25- 11:40 2.04 **A Three-Dimensional Integration Technology with Embedded Au Electrodes for stacked CMOS Image Sensors**
Masahide Goto[1], Kei Hagiwara[1], Yoshinori Iguchi[1], Hiroshi Ohtake[1], Takuya Saraya[2],Masaharu Kobayashi[2], Eiji Higurashi[2], Hiroshi Toshiyoshi[2],Toshiro Hiramoto[2]
[1] NHK Science and Technology Research Laboratories, Tokyo, Japan,
[2] The University of Tokyo, Tokyo, Japan

11:40– 12:10 **Group Picture**

12:10– 13:40 **Lunch**

Session 03 Imaging Devices, Characterization and Modeling

13:40- 13:55 3.01 **Detection and Shielding of Photon Emission in Stacked CIS**
Calvin Chao, Chin-Hao Chang, Manoj Mhala, Hon-Yih Tu,Shang-Fu Yeh,Kuo-Yu Chou, Po-Sheng Chou, Charles Liu, and Fu-Lung Hsueh
Taiwan Semiconductor Manufacturing Company, Hsinchu, Taiwan

13:55 - 14:10 3.02 **The source decomposition of Dark FPN and its improvement by Stacked CIS process**
Y. Yamashita, W.H. Wu, W.J. Chiang, C.H. Chung, R.J. Lin, J.J. Sze, J.C. Liu, C.H.Tseng, H. Sumiand, S.G. Wuu
Taiwan Semiconductor Manufacturing Company, Ltd., Hsinchu, Taiwan

14:10 - 14:25 3.03 **Interface State Generation by Substrate Injection Through the Transfer Gate**
Chris Hong[1], Rick Jerome[1], David Price[1], Verne Hornback[1], Kyle Thomas[2], Rusty Winzenread[2]
[1] ON Semiconductor, Gresham, OR, USA
[2] ON Semiconductor, Santa Clara, CA, USA

14:25 - 14:40 3.04 **Absolute Pinning Voltage Measurement: Comparison between In-pixel and JFET Extraction Methods**
A. Pelamatti[1], V. Goiffon[1], A. De Ipanema[1], P. Magnan[1], C. Virmontois[2] O. Saint-Pe[3], M. Breart de Boisanger[3]
[1] ISAE Toulouse [2]CNES, Toulouse, [3]Airbus Defence and Space, Toulouse, France

14:40 - 14:55 3.05 **Fully Depleted SOI Pixel Photo Detectors with Backgate Surface Potential Pinning**
Hiroki Kamehama[1], Shoji Kawahito[1], Sumeet Shrestha[1], Keita Yasutomi[1], Keiichiro Kagawa[1],Aayaki Takeda[2],Takeshi Go Tsuru[2],and Yasuo Arai[3]
[1]Research Institute of Electronics, Shizuoka University, Hamamatsu, Japan
[2]Department of Physics, Kyoto University, Sakyo, Japan
[3]National High Energy Accelerator Research Organization, Ibaraki Japan

14:55 – 15:15 **Break**

Session 04 Spectral Imaging and Microlenses

15:15- 15:30 4.01 **Two Layer Image Sensor Pixel Concept for Enhanced Low Light Color Imaging**
Leo Anzagira, Eric R. Fossum
Thayer Engineering School, Dartmouth College, Hanover, NH, USA

15:30 - 15:45 4.02 **New Color Filter Patterns and Demosaic for Sub-micron Pixel Arrays**
Biay-Cheng Hseih[1], Hasib Siddiqui[1], Jiafu Luo[1], Todor Gerogiev[1], Kalin Atanassov[1], Sergio Goma[1], and HY Cheng[2], JJ Sze[2], RJ Lin[2], HY Chou[2], Calvin Chao [2], SG Wuu[2]
[1]Qualcomm Inc., San Diego,CA,USA, [2]TSMC,Hsinchu, Taiwan

15:45 - 16:00 4.03 **A 80% QE High Readout Speed 1024 Pixel Linear Photodiode Array for UV-VIS-NIR Spectroscopy**
Rihito Kuroda[1], Takahiro Akutsu[1], Yasumasa Koda[1], Kenji Takubo[2], Hideki Tominaga[2] Ryuuta Hirose[2], Tomohiro Karasawa[2] and Shigetoshi Sugawa[1]
[1]Graduate School of Engineering, Tohoku University, Japan
[2]Shimadzu Corporation Sendai, Miyagi, Japan

16:00 - 16:15 4.04 **Pixel performance enhancement by integrated diffractive optics**
V. Rochus, Xavier Rottenberg, Ingrid De Wolf, Philippe Soussan, and Piet De Moor
Imec, Leuven, Belgium

Session 05 Poster Flash Presentations (Group 1)

16:15 - 17:15

5.01 **On Chip Optics Solution on Small Pixel CIS S/N Ratio Improvement**
Chih-Ching Chang, Wu-Cheng Kuo , Ken_Wu , Yu-Kun Hsiao, JC_Hsieh.
VisEra Technologies Company, Hsinchu Science Park, Taiwan

5.02 **Color Filter Array Patterns Designed to Mitigate Crosstalk Effects in Small Pixel Image Sensors**
Leo Anzagira and Eric R. Fossum,
Thayer Engineering School, Dartmouth College, Hanover, NH , USA

5.03 **Read Noise Distribution Measurement and Modeling of CMOS Image Sensors**
Boyd Fowler, Clemenz Portmann, Lele Wang and Steve Tran
Google Inc., Mountain View CA 94043 USA

5.04 **Twinkling Behavior in Ultra-High-Resolution CMOS Global Shutter Pixels**
Tsung-Hsun Tsai, David Marchesan, Naser Faramarzpour, Matthias Sonder, Eric Fox
Teledyne DALSA Inc., Waterloo, ON, Canada

5.05 **Electrical Characterization Method for Two Stage Transfer Global Shutter Pixels**
Manuel Innocent
ON Semiconductor, Mechelen, Belgium.

5.06 **CMOS Image Sensor for Multi-Aperture Optics - A 15x9 Array sensor for low z-height 720p camera modules with depth information**
Harald Neubauer, Thomas Schweiger
Fraunhofer Institute for Integrated Circuits (IIS), Erlangen, Germany

5.07 **Lens-free holographic imaging of microscopic objects using photonic structures and CMOS imagers**
Murali Jayapala, Richard Stahl, Geert Vanmeerbeeck, Andy Lambrechts
IMEC, Leuven, Belgium

5.08 **Design and Optimisation of Large 4T Pixel**
Xuezhou Cao[1], Daniel Gäbler[2], Chris Lee[1], Tee Pei Ling[3], Devorah Anak Jarau[3], David Kho Ching Tien[3], Teo Boon Chuan[3], Brendan Bold[1]
[1,2]X-FAB Semiconductor Foundries AG,[1]Branch Office Plymouth, Plymouth, UK, [2]Erfurt, Germany
[3]X-FAB Sarawak Sdn. Bhd., Sarawak, Malaysia

5.09 **Investigating Transfer Gate Potential Barrier by Feed-Forward Effect Measurement**
Yang Xu[1], Xiaoliang Ge[1] Albert J.P. Theuwissen[1,2]
[1]Delft University of Technology, Delft, the Netherlands
[2]Harvest Imaging, Bree, Belgium

5.10 **Analysis and Reduction of Floating Diffusion Capacitance Components of CMOS Image Sensor for Photon-Countable Sensitivity**
Fumiaki Kusuhara, Shunichi Wakashima, Satoshi Nasuno, Rihito Kuroda and Shigetoshi Sugawa
Graduate School of Engineering, Tohoku University, Japan

5.11 **A 30 fps 1920 x 1080 pixel Electron Multiplying CCD Image Sensor with Per-Pixel Switchable Gain**
C. Parks, S. Kosman, E. Nelson, N. Roberts, and S. Yaniga
ON Semiconductor , Rochester, USA

5.12 **Superlattice-doped detectors for UV through gamma-ray imaging and spectroscopy**
M. E. Hoenk[1] , J. Hennessy[1] , A. D. Jewell[1] , A. G. Carver[1] , T. J. Jones[1] , S. Nikzad[1], M. McClish[2] ,S. Tsur[3] , G. Meynants[4], J. Sgro[5]
[1] Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA
[2] Radiation Monitoring Devices, Inc., 44 Hunt Street, Watertown, MA, USA
[3] Applied Materials Inc., 9 Oppenheimer St., Rehovot, Israel
[4] CMOSIS , Antwerp, Belgium [5] Alacron, Inc., Nashua, NH , USA

5.13 **Investigation of Implantation Damage Recovery using Microwave Annealing for High Performance Image Sensing Devices.**
Masatoshi Kimura[1], Tadashi Yamaguchi[2] and Takashi Kuroi[1]
[1]Technology Division, Renesas Semiconductor Manufacturing Corp., Japan
[2]Production Technology Development Unit, Renesas Electronics Corp., Japan

5.14 **The Delamination Defect Improvement of High Transmittance Dielectric (HTD) Film on BSI Image Sensor Manufacturing**
Sung-Han Tsai, Yun-Wei Cheng, Chun-Hao Chou, Kuo-Cheng Li, Hsin-Chi Chen, Yung-Lung Hsu
Taiwan Semiconductor Manufacturing Company, Tainan, Taiwan

5.15 **Active Pixel Concepts for High-Resolution Large Area Imagers**
Florian De Roose[1,2], Soeren Steudely[2], Pawel E. Malinowskiy[2], Kris Myny[2], Adi Xhakoni[1],Georges Gielen[1,2], Jan Genoey[1,2], Wim Dehaene[1,2]
[1]Department of Electrical Engineering (ESAT), KU Leuven, Belgium
[2]Large Area Electronics Department, IMEC, Belgium

5.16 **High-density 3D interconnects Technology: The key for burst-mode very high speed imaging?**
Philippe Martin-Gonthier, Fernando Raymundo, Pierre Magnan
ISAE, Toulouse, France

5.17 **CMOS image sensor with pseudorandom pixel placement for jaggy reduction in line representation**
Chihiro Izaki, Junichi Akita
Kanazawa University, Kanazawa, Japan

5.18 **A Dual-Mode CMOS Imager for Free-Space Optical Communication with Signal Light Source Tracking and Background Cancellation**
Chih-Hao Lin, Chih-Cheng Hsieh
Department of Electrical Engineering, National Tsing Hua University, Hsinchu, Taiwan

5.19 **Imaging sparse events at high speed**
Gaozhan Cai, Bart Dierickx, Bert Luyssaert, Nick Witvrouwen, Gerlinde Ruttens
Caeleste CVBA, Mechelen, Belgium

17:15- 18:45 Poster Viewing Session (Group 1) and "Meet the Authors" Session

18:45 **Dinner**

Tuesday, June 9th 2015

Session 06 High speed, Gated and Time-Of-Flight Imaging

08:45- 09:00 6.01 **Notes about the limits of ultra-high speed solid-state imagers**
R. Turchetta
Rutherford Appleton Laboratory, Science and Technology Facilities Council (STFC), Harwell Science and Innovation Campus, U.K

09:00 - 09:15 6.02 **Toward 10 Gfps: Factors Limiting the Frame Rate of the BSI MCG Image Sensor**
V. T. S. Dao[1,6], T. G. Etoh[1], K. Shimonomura[1], Q. Nguyen[1], N. Hayashi[2], Y. Kamakura[3], C. Zhang[4], E. Charbon[4], P. Goetschalckx[5], Luc Haspeslagh[5], and P. De Moor[5]
[1]Ritsumeikan University Kusatsu Japan, [2]Astrodesign Inc., [3]Osaka University, [4]Technical University Delft, [5]IMEC, [6]Research Institute for Science and Technology, Ritsumeikan University, Kusatsu JAPAN

09:15 - 09:30 6.03 **A 20Mfps Global Shutter CMOS Image Sensor with Improved Sensitivity and Power Consumption**
Shigetoshi Sugawa, Rihito Kuroda, Tohru Takeda, Fan Shao, Ken Miyauchi and Yasuhisa Tochigi
Graduate School of Engineering, Tohoku University, Japan

09:30 - 09:45 6.04 **Oversampled ITOF Imaging Techniques using SPAD-based Quanta Image Sensors**

Neale A.W. Dutton[1,2], Luca Parmesan[1,2], Salvatore Gnecchi[1,2], Istvan Gyongy[2], Neil Calder[2], Bruce R. Rae[1], Lindsay A. Grant[1], Robert K. Henderson[2]
[1]STMicroelectronics, Imaging Division, Edinburgh, UK
[2]The University of Edinburgh, Edinburgh, UK

9:45 - 10:00 6.05 **A Fast Gated CMOS Image Sensor with a Vertical Overflow Drain Shutter Mechanism**

Erez Tadmor[1,3] , Assaf Lahav[2], Alex Fish[3], Giora Yahav[1], David Cohen[1]
[1]Advanced Imaging Technologies Group, Microsoft R&D Center, Haifa, Israel
[2]Tower-Jazz Semiconductor Ltd. Migdal Haemek, Israel
[3]Faculty of Engineering, Bar-Ilan University, Ramat Gan, Israel

10:00 - 10:15 6.06 **A multi-aperture compressive time-of-flight CMOS imager for pixelwise coarse histogram acquisition**

Futa Mochizuki[1], Keiichiro Kagawa[1], Min-Woong Seo[1], Taishi Takasawa[1],Keita Yasutomi[1], and Shoji Kawahito[1]
[1]Research Institute of Electronics, Shizuoka University, , Hamamatsu, Japan

10:15 - 10:35 **Break**

10:35 - 11:15 **<u>Keynote presentation:</u>**

History of the creation of MOS vision sensor arrays and associated topics
And what does – or should - the future hold?

Peter JW Noble
2015 IISS Pioneering Achievement Award recipient.

Session 07	**Poster Flash Presentations (Group 2)**

11:15 - 12:15

7.01 **Designing pixel parallel localized drivers of a 3D 1Gfps image sensor family**

C. Zhang[1] V. T. S. Dao[2], T. G. Etoh[2], K. Shimonomura[2], E. Charbon[1]
[1]Delft University of Technology, the Netherlands; [2]Ritsumeikan University, Japan

7.02 **A 25 Mpixel, 80fps, CMOS Imager with an In-Pixel-CDS Global Shutter Pixel**

Tomas Geurts, Thomas Cools, Cedric Esquenet, Rahul Sankhe, Anilkumar Prathipati, Mukesh Rao Engla Syam, Aniruddha Bangalore Dayalu, V. Penchala Reddy Gaddam
ON Semiconductor, Belgium

7.03 **A 14-bit, 33-Mpixel, 120-fps Image Sensor with DMOS Capacitors in 90-nm/65-nm CMOS**

T. Yasue[1], K. Kitamura[1], T. Watabe[2], H. Shimamoto[1], T. Kosugi[3], T. Watanabe[3],S. Aoyama[3], M.Monoi[4], Z. Wei[5] and S. Kawahito[5]
[1]NHK Science and Technical Research Laboratories, Tokyo, JAPAN, [2]NHK Engineering System Inc., Japan, [3]Brookman Technology, Inc., Japan, [4]Toshiba Corporation Semiconductor & Storage Products Company, Japan, [5]Shizuoka University, Japan

7.04 **Piece-Wise-Linear Ramp ADC for CMOS Image Sensor and Calibration Techniques**

C. Pastorelli[1,2,3], P. Mellot[1], S. Mir[2,3], C. Tubert[1]
[1]STMicroelectronics, Grenoble, France [2]Université Grenoble Alpes, TIMA, Grenoble, France [3]CNRS, TIMA, Grenoble, France

7.05 **A 305ns Conversion-Time, 13-bit All-Digital Column Analog-to-Digital Converter for CMOS Image Sensors in 180nm Technology**

Ha Le-Thai[1], Adi Xhakoni[1], Genis Chapinal[2], Manuel Innocent[2], Tomas Geurts[2], Georges Gielen[1]
[1]KU Leuven, ESAT-MICAS, Heverleen, Belgium,
[2]ON Semiconductor, Mechelen, Belgium

7.06 **High-Speed, High Sensitivity 25 Mega Pixel CMOS Image Sensor with Column Parallel 12 bit Hybrid ADC Architecture**

Canaan Sungkuk Hong, Krishna Palle, Toan Bao, Vivian Wang, Yuan Fong, Woonil Choi, Kwang-Bo Cho, Roger Panicacci
ON Semiconductor, San Jose, California, USA

7.07 **Preliminary Experiment for Precise and Dynamic Digital Calibration for Two-Stage Cyclic ADC Suitable for 33-Mpixel 120-fps 8K Super Hi-Vision CMOS Image Sensor**

Toshihisa Watabe[1], Kazuya Kitamura[2], Tomohiko Kosugi[4], Hiroshi Ohtake[2], Hiroshi Shimamoto[2], and Shoji Kawahito[3,4]
[1]NHK Engineering System, Inc., Tokyo, Japan, [2]NHK Science & Technology Research Laboratories, Tokyo, Japan , [3]Research Institute of Electronics, Shizuoka University, Hamamatsu, Japan [4]Brookman Technology Inc., Hamamatsu, Japan

7.08 **Backside illuminated 84 dB global shutter image sensor**

G. Meynants, G. Beeckman, K. Van Wichelen, T. De Ridder, M. Koch, G.Schippers, M. Bonnifait, W. Diels, J. Bogaerts
CMOSIS nv, Antwerp, Belgium

7.09 **A Global Shutter sensor used in Active Gated Imaging for automotive**

Assaf Lahav[1], Adi Birman[1], Denis Perhest[1], Amos Fenigstein[1], Yoav Grauer[2,] Eyal Levi[2]
[1]TowerJazz, Migdal Haemek , Israel
[2]BrightWay Vision TM LTD, Haifa, Israel

7.10 **A Smart CMOS Sensor for Optical Touch Screen Applications**

Yang NI, Yiming Zhu, Bogdan Arion
New Imaging Technologies SA, Verrières le Buisson France

7.11 **PTC Inspired Column Level Compression in Low Power CMOS Imagers**

B. Bhuvan, M. Sarkar and S. Chatterjee
Department of Electrical Engineering, Indian Institute of Technology Delhi, New Delhi, India

7.12 **Linear Mode High Dynamic Range Bouncing Pixel with Single transistor**

Carlos A. de Moraes Cruz[1], Pablo N. A. Belmonte[2], Davies W. de Lima Monteiro[2]
[1]Department of Electronics and Computation, Universidade Federal do Amazonas, Manaus, Brazil. [2]Department of Electrical Engineering, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.

7.13 **Four Concepts for Synchronous, PSN limited, true CDS, HDR imaging**

A.K.Kalgi, B.Dierickx, B.Dupont, P.Coppejans, P.Gao, B.Spinnewyn, B.Luyssaert, A. Defernez, J. Zhu, J.Basteleus, Q. Yao, W. Verbruggen, D. Uwaerts, B. Uwaerts, G. Ruttens, G. Cai
Caeleste CVBA, Mechelen, Belgium

7.14 **Spatiotemporally Varying Exposure Imaging for High Quality Image Reconstruction**
Hidenori Tabata, Tomohiro Yamazaki, Toshinori Otaka and Takayuki Hamamoto
Tokyo University of Science, Tokyo , Japan

7.15 **A single-exposure linear HDR 17-bit hybrid 50µm analogue-digital pixel in 90nm BSI**
Jeffrey M. Raynor[1], Andrew Scott[1,2], Christopher Holyoake[1,3], Donald S. Reay[2]
[1]STMicroelectronics, Imaging Division, 33 Pinkhill, Edinburgh, UK
[2]School of Engineering & Physical Sciences, Heriot-Watt University, Edinburgh, UK
[3]School of Engineering & Electronics, The University of Edinburgh, Edinburgh, UK

7.16 **Time-resolved imaging device with high-speed modulators for fluorescence lifetime measurement system**
Min-Woong Seo, Keiichiro Kagawa, Keita Yasutomi, Nobukazu Teranishi,and Shoji Kawahito
Research Institute of Electronics, Shizuoka University, Hamamatsu, Japan

7.17 **Compact time-gated analog counting SPAD-based pixels for high resolution, single-photon, time-resolved imagers**
L.Gasparini[1], N.Massari[1], M.Perenzoni[1], L.Pancheri[2], D.Stoppa[1]
[1]Fondazione Bruno Kessler, Trento, Italy , [2]University of Trento,Trento, Italy

7.18 **A 15um CAPD Time-of-Flight pixel with 80% modulation contrast at 100MHz**
Daniel Van Nieuwenhove, Kyriaki Fotopoulou, Camilo Ernesto Medina López, Ward van der Tempel
SoftKinetic, Brussels, Belgium

7.19 **Optimization of pulse-modulation based ToF imaging systems**
Andreas Süss[1,2], Yenn Leng Tanz[3], Maarten Rosmeulen[2], Bedrich J. Hosticka[1,3]
[1]Fraunhofer IMS, Duisburg, Germany [2]IMEC, Leuven, Belgium, [3]University Duisburg-Essen, Germany

12:45 - 17:15	**Social Event : Cave Biking**

17:15- 18:45	**Poster Viewing Session (Group 2) and "Meet the Authors" Session**

18:45 **Dinner**

Wednesday, June 10th 2015

Session 8	**Non Visible Imaging**

08:45- 09:25
8.01 **Invited presentation:**

Infrared Imagers State-Of-Art
E. Mazaleirat
Sofradir, France

09:25 - 09:40
8.02

Silicon and III-N UV Photon Counting Detectors

Shouleh Nikzad, John J. Hennessy, Michael E. Hoenk, April D. Jewel, Alex G. Carver, Timothy M. Goodsall, Todd J. Jones, Erika Hamden, and L.Douglas Bell
Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA, USA

09:40 - 09:55
8.03

Flexible X-ray detector with high sensitivity using low cost, solution-processed organic photodiodes

Abhishek Kumar[1], Date Moet[1], Jan-Laurens van der Steen[1], Albert van Breemen[1], Santosh Shanmugam[1], Arjan Langen[1], ,Jan Gilot[1], Pim Groen[1], Ronn Andriessen[1], Matthias Simon[2], Walter Ruetten[2], Alexander Douglas[2], Rob Raaijmakers[3], Pawel E. Malinowski[4], Kris Myny[4] and Gerwin H.Gelinck[5]
[1]Holst Centre/TNO, Eindhoven, The Netherlands, [2] Philips Research, Eindhoven, The Netherlands, [3] Philips Healthcare, PC Best, The Netherlands, [4]IMEC, Department of Large Area Electronics, Leuven, Belgium, [5]Applied Physics Department, TU Eindhoven, The Netherlands

09:55- 10:10
8.04

PixFEL project: hybrid High Dynamic Range X-ray image sensor for application at future FEL facilities

Lucio Pancheri [1,2], Mohamed El Amine Benkechkache[1], Roberto Mendicino[1,2], Hesong Xu[1,2], Gian-Franco Dalla Betta[1,2], Giovanni Verzellesi[3,2], Daniele Comotti[4,5], Lodovico Ratti[4,5], Marco Grassi[4,5], Luca Lodola[4,5], Piero Malcovati[4,5], Carla Vacchi[4,5], Lorenzo Fabris[4,5], Massimo Manghisoni[6,5], Valerio Re[6,5], Gianluca Traversi[6,5], Giovanni Batignani[7,8], Stefano Bettarini[7,8], Giulia Casarosa[7,8], Francesco Forti[7,8], Antonio Paladino[7,8], Eugenio Paoloni[7,8], Giuliana Rizzo[7,8], Fabio Morsani[8]
[1]Dip. di Ingegneria Industriale (DII), Università di Trento, Trento, Italy. [2]TIFPA-INFN, Trento, Italy.
[3]DISMI, Università di Modena e Reggio, Italy. [4]Dipartimento di Ingegneria Industriale e dell'Informazione, Università di Pavia, Italy. [5]INFN Sezione di Pavia, Pavia, Italy.
[6]Dip. di Ingegneria e Scienze Applicate, Università di Bergamo, Dalmine (BG) Italy.
[7]Dip. di Fisica, Università di Pisa, Pisa, Italy. [8]INFN Sezione di Pisa, Pisa, Italy.

10:10 - 10:25
8.05

Monolithic Active Pixel Sensor Development for the Upgrade of the Inner Tracking System of the ALICE Experiment at CERN

W. Snoeys et al. representing the ALICE ITS upgrade collaboration.
CERN, Geneva, Switzerland

10:25– 10:45 **Break**

Session 09 Innovative Photon Counting

0:45- 11:00
9.01

Bit-plane Processing Techniques for Low-Light, High Speed Imaging with a SPAD-based QIS

Istvan Gyongy[1], Neale Dutton[2], Luca Parmesan[1], Amy Davies[3], Rebecca Saleeb[3], Rory Duncan[3], Colin Rickman[3], Paul Dalgarno[3], Robert K. Henderson[1]
[1]The University of Edinburgh, Edinburgh, U.K.
[2]STMicroelectronics Imaging Division, , Edinburgh
[3]Heriot-Watt University, Institute of Biological Chemistry, Biophysics and Bioengineering, Edinburgh, U.K.

11:00 - 11:15
9.02

A 2.5pJ/b Readout Circuit for 1000fps Single-bit Quanta Image Sensor

Saleh Masoodian, Arun Rao, Jiaju Ma, Kofi Odame and Eric R. Fossum
Thayer School of Engineering, Dartmouth College, Hanover, NH, USA

11:15 - 11: 30
9.03

Multi-Bit Quanta Image Sensors

Eric R. Fossum,
Thayer School of Engineering at Dartmouth, Hanover, NH, USA

11:30 - 11: 45 9.04 **A 256x256 SPAD array with in-pixel Time to Amplitude Conversion for Fluorescence Lifetime Imaging Microscopy**

Luca Parmesan[1,2], Neale A.W. Dutton[1,2], Neil Calder[1], Lindsay A. Grant[2], Robert K. Henderson[1]
[1]The University of Edinburgh, Edinburgh, UK
[2]STMicroelectronics, Imaging Division, Edinburgh UK

11:45 -12: 00 9.05 **Progress toward a high-resolution single-photon camera based on superconducting single photon detector arrays and compressive sensing**

Thomas Gerrits[1], Shane Allman[1], Daniel J. Lum[2], Varun Verma[1], John Howell[2], Rich Mirin[1], Sae Woo Nam[1]
[1]National Institute of Standards and Technology, Boulder, USA
[2]University of Rochester, Department of Physics and Astronomy, NY, USA

12:00 - 13:30 **Lunch**

Session 10 Specialty Image Sensors

13:30 - 13:50 10.01 **Introductory paper:**
Scientific, Back Illuminated CCD development for the Transiting Exoplanet Survey Satellite

Vyshi Suntharalingam,
MIT Lincoln Lab, USA

13:50 - 14:05 10.02 **CMOS Charge Transfer TDI With Front Side Enhanced Quantum Efficiency**

F. Mayer, S. Pesenti, F. Barbier, H. Bugnet, J. Endicott, F. Devriere, T. Ligozat
e2v semiconductors, Saint Egrève, France

14:05 - 14:20 10.03 **A CMOS Image Sensor with 240μV/e- Conversion Gain, 200ke- Full Well Capacity and 190-1000nm Spectral Response**

Satoshi Nasuno, Shunichi Wakashima, Fumiaki Kusuhara, Rihito Kuroda, Shigetoshi Sugawa
Graduate School of Engineering, Tohoku University, Japan

14:20- 14:35 10.04 **A 2MP Oversampling Image Sensor with 2.75μs Row Time and Conditional Threshold Comparison**

Thomas Vogelsan[1], Michael Guidash[1], Craig Smith[1], Jay Endsley[1], Loc Truong[2] and Rami Yassine[2]
[1] Rambus Inc., Sunnyvale, CA, USA ; [2] Forza Silicon Inc., Pasadena, CA, USA

14:35- 14:50 10.05 **A 4M,1.4e-noise, 96dB dynamic range, back-side illuminated CMOS image sensor**

Xinyang Wang [1,2], Cheng Ma[1,2]
[1]Gpixel Inc., ChangChun, China, [2]ChangChun Institute of Optics, Fine Mechanics and Physics, CAS, Changchun, China

14:50 – 15:05 10.06 **Toward Multi-MGy / Grad Radiation Hardened CMOS Image Sensors for Nuclear Applications**

V. Goiffon[1], F. Corbière[1], S. Rolando[1], M. Estribeau[1], P. Magnan[1], B. Avon[1], J. Baer[1], M. Gaillardin[2], P. Paillet[2], S. Girard[3], R. Molina[1], A. Chabane[1], C. Marcandella[2]
[1]ISAE, Toulouse, France / [2]CEA, DAM, DIF, France / [3]Université de Saint-Etienne, Laboratoire Hubert Curien, UMR-CNRS France

15:05– 15:25 **Break**

Session 11 — Charge Multiplication Devices and Image Sensors

15:25- 15:40 11.01
Electron Multiplying Device Made on a 180 nm Standard CMOS Imaging Technology
Pierre Fereyre[1], Frédéric Mayer[1], Clément Buton[2], Timothée Brugière[2], Mathieu Fournier[1,3], Rémi Barbier[2]
[1]e2v, France, [2]CNRS/IN2P3, Institut de Physique Nucléaire de Lyon, France, [3]Lyon University, France

15:40 - 15:55 11.02
Backside-Illuminated 4-T Pinned Avalanche Photodiode Pixel for Readout Noise-Limited Applications
Tomislav Resetar[1,2], Koen De Munck[2], Luc Haspeslagh[2], Piet De Moor[2], Paul Goetschalckx[2], Robert Puers[1,2] and Chris Van Hoof[1,2]
[1]K.U. Leuven, ESAT, Leuven, Belgium ; [2]IMEC, Leuven, Belgium

15:55 - 16:10 11.03
A Flexible 32x32 SPAD Image Sensor with Integrated Microlenses
P. Sun, E. Charbona and R.Ishihara
Delft University of Technology, Delft, The Netherlands

16:10 - 16:25 11.04
A NIR-Sensitivity-Enhanced Single-Photon Avalanche Diode in 0.18µm CMOS
Cristiano Niclass, Hiroyuki Matsubara, Mineki Soga, Mitsuhiko Ohta, Masaru Ogawa, and Tatsuya Yamashita.
Toyota Central R&D Labs, Inc., Nagakute, Aichi, Japan

16:25 - 16:40 11.05
Characterization of Single-Photon Avalanche Diodes in Standard 140-nm SOI CMOS Technology
Myung-Jae Lee, Pengfei Sun, and Edoardo Charbon
TU Deft, The Netherlands

16:40 - 16:55 11.06
High-Sensitivity Image Sensor with Stacked Structure comprising Crystalline Selenium Photoconductor, Crystalline OS FET and CMOS FET
Yoshiyuki Kurokawa[1], Takashi Nakagawa[1], Shuhei Maeda[1], Takuro Ohmaru[1], Takayuki Ikeda[1],Yasutaka Suzuki[1], Naoto Yamade[1], Hidekazu Miyairi[1], Shigeyuki Imura[2], Kenji Kikuchi[2],Kazunori Miyakawa[2], Hiroshi Ohtake[2], Misao Kubota[2], Makoto Ikeda[3], and Shunpei Yamazaki[1]
[1] Semiconductor Energy Laboratory, Kanagawa, Japan
[2] NHK Science and Technology Research Laboratories, Tokyo, Japan
[3] Department of Electrical Engineering and Information Systems, The University of Tokyo, Japan

16:55- 17:55 — "Meet the Authors" Session

18:45 **Gala Dinner and 2015 IISS Awards**

- *Best Poster Award*
- *Walter Kosonocky Award*
- *2015 IISS Exceptional Lifetime Achievement Award to* ***Jerry Hynecek***
  For exceptional technical contributions to the field of solid-state image sensors
- *2015 IISS Pioneering Achievement Award to* ***Peter JW Noble***
  For exceptional contribution to pioneering techniques in the field of solid-state image sensors

Thursday, June 11th 2015

Session 12	Noise

08:45- 09:25 12.01
Invited presentation:
An overview of state-of-the-art denoising and demosaicing techniques: toward a unified framework for handling artifacts during image reconstruction
B. Goossens , Hiep Luong, Jan Aelterman, Aleksandra Pizurica, Wilfried Philips
Ghent University, Belgium

09:25 - 09:40 12.02
A low-noise, P-type, vertically-pinned and back-side illuminated pixel structure for image sensor applications
B. Mamdy[1,2] , F. Roy[1] ,G.N. Lu[2], N. Ahmed[1,2]
[1]STMicroelectronics, Crolles, France
[2]Institut des Nanotechnologies de Lyon (INL), Université Claude Bernard Lyon 1, Villeurbanne, France

09:40 - 09:55 12.03
A 0.4 e-rms Temporal Readout Noise, 7.5 µm pitch and a 66% fill factor Pixel for Low Light CMOS Image Sensors
Assim Boukhayma[1,2], Arnaud Peizerat[1] and Christian Enz[2]
[1]CEA-LETI, Grenoble, France ; [2]ICLAB, EPFL, Switzerland

09:55- 10: 10 12.04
CMOS image sensor reaching 0.34 e-RMS read noise by inversion-accumulation cycling
Qiang Yao, Bart Dierickx, Benoit Dupont
Caeleste, Mechelen, Belgium.

10:10 - 10: 25 12.05
Night Vision CMOS Image Sensors Pixel for SubmilliLux Light Conditions
Amos Fenigstein, Adi Birman, and Assaf Lahav
TowerJazz Semiconductor, Migdal Haaemek, Israel

10:25– 10:55 **Break**

Session 13	High Dynamic Range Imagers and SOC

10:55- 11:10 13.01
A 1280x1080 4.2µm Split-diode Pixel HDR Sensor in 110nm BSI CMOS Process
Trygve Willassen[1], Johannes Solhusvik[1], Robert Johansson[1], Sohrab Yaghmai[1], Howard Rhodes[2], Sohei Manabe, Duli Mao[2], Zhiqiang Lin[2], Dajiang Yang[2], Orkun Cellek[2], Eric Webster[2], Siguang Ma[2], and Bowei Zhang[2]
[1]OmniVision Technologies, [1]Gaustadalléen 21, 0349 Oslo, Norway,
[2]OmniVision Technologies, Santa Clara, USA

11:10 - 11:25 13.02
High Performance 1.3MPix HDR Automotive Image Sensor
Tarek Lulé[1], Christophe Mandier[1], Arnaud Glais[1], Gregory Roffet[1], Roger Monteith[2], Benoit Deschamps[1]
[1] STMicroelectronics, Imaging Division, Grenoble, France ; [2]STMicroelectronics, Imaging Division, Edinburgh, UK

11:25 - 11: 40 13.03
A 120dB DR and 5µm pixel pitch imager based on local integration time adaptation
A. Peizerat[1], F. Guezzi[1], A. Dupret[1], R. Jalby[1], L. Bruno de Sa[1], M. Benetti[1], W. Guicquero[1], Y.Blanchard[2]
[1]CEA-LETI, Grenoble, France ; [2]ESIEE, Noisy-Le-Grand, France

11:40 - 11: 55
13.04

A 1 MPix HDR Image Sensor SoC with Highly Parallel Mixed-Signal Processing

Jens Döge, Christoph Hoppe, Peter Reichel and Nico Peter Fraunhofer
Institute for Integrated Circuits IIS, Design Automation Division EAS,Dresden, Germany

11: 55 – 12: 10
13.05

Design of an RGBW Color VGA Rolling and Global Shutter Dynamic and Active-pixel Vision Sensor

Chenghan Li, Christian Brandli, Raphael Berner, Hongjie Liu, Minhao Yang, Shih-Chii Liu, Tobi Delbruck
Institute of Neuroinformatics, UZH & ETHZ, Zurich, Switzerland

12:10– 12:25
13.06

Automatic DR and spatial sampling rate adaptation for secure and privacy-aware ROI tracking based on focal-plane image processing

Ricardo Carmona-Galán, Jorge Fernández-Berni, Ángel Rodríguez-Vázquez
Institute of Microelectronics of Seville, Seville, Spain

12:25– 13:55 **Lunch**

Session 14 Global Shutter and ADC

13 :55- 14:10
14.01

A High Speed 1 MPix Sensor with Floating Storage Gate Pixel

Alex Krymski
Luxima Technology LLC, Pasadena, CA, USA

14:10 - 14:25
14.02

A 1.2 MP 1/3" CMOS Image Sensor with Light Flicker Mitigation

Chris Silsby[1], Sergey Velichko[2], Scott Johnson[2], Yan Ping Lim[1], Ray Mentzer[1], Jeff Beck[1]
[1]ON Semiconductor, Corvallis, OR, USA ; [2]ON Semiconductor, Meridian, ID, USA

14:25 - 14:40
14.03

700 frames/s 2 MPixel global shutter image sensor with 2 Me- full well charge and 12 µm pixel pitch

***G**. Meynants, X. Wu, S. Vanhoogenbemt, T. De Ridder, P. De Wit, K. Ruythooren, K. Van Esbroeck*
CMOSIS, Antwerp, Belgium

14:40- 14:55
14.04

A Flexible 14-bit Column-Parallel ADC Concept for Application in Wafer-Scale X-ray CMOS Imagers

Henk Derks, Daniel Verbugt, Laurens Korthout, Wim de Haan, Wasim Muhammad, Pierluigi Albertini
Teledyne-DALSA Professional Imaging, Eindhoven, The Netherlands

14:55- 15:10
14.05

A Two Conversions/Sample Differential Slope Multiple Sampling ADC With Accelerated Counter Architecture

Kazuya Kitamura[1], Albert Theuwissen[2,3]
[1]NHK Science and Technical Research Laboratories, Tokyo, Japan
[2]Delft University of Technology, Delft, The Netherlands, [3]Harvest Imaging, Bree, Belgium

15:10– 15:25 **Wrap Up and Closing**